WHAT IS CLAIMED IS:

1. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and the time ratios up to the n-th time ratio are set so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

2. The method for driving a piezoelectric transformer according to claim 1, wherein the load is a cold-cathode tube.

3. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the time ratio is set to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input

currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

4. The method for driving a piezoelectric transformer according to claim 3, wherein the load is a cold-cathode tube.

5. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, a sum of the first time ratio and the second time ratio is set to be smaller than 0.5, and the first time ratio and the second time ratio are set so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

6. The method for driving a piezoelectric transformer according to claim 5, wherein the load is a cold-cathode tube.

7. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and the time ratios up to the n-th time ratio are set so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

8. The method for driving a piezoelectric transformer according to claim 7, wherein the load is a cold-cathode tube.

9. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the time ratio is set to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

10. The method for driving a piezoelectric transformer according to claim 9, wherein the load is a cold-cathode tube.

11. A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, comprising the steps of:

detecting an output state to the load to generate a detection signal; and

generating the driving signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, a sum of the first time ratio and the second time ratio is set to be smaller than 0.5, and the first time ratio and the second time ratio are set so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

12. The method for driving a piezoelectric transformer according to claim 11, wherein the load is a cold-cathode tube.

13. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time

ratio to be smaller than 0.5, and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

14. The driving circuit for a piezoelectric transformer according to claim 13, wherein the load is a cold-cathode tube.

15. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and

the driving section includes at least two switching elements, and the control section controls a duty ratio or a phase of at least two control signals to be supplied to the switching elements, thereby setting the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

16. The driving circuit for a piezoelectric transformer according to claim 15, wherein the load is a cold-cathode tube.

17. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving

signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5, and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer.

18. The driving circuit for a piezoelectric transformer according to claim 17, wherein the load is a cold-cathode tube.

19. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform

having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5, and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

20. The driving circuit for a piezoelectric transformer according to claim 19, wherein the load is a cold-cathode tube.

21. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and

the driving section includes at least two switching elements, and the control section controls a duty ratio or a phase of at least two control signals to be supplied to the switching elements, thereby setting the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

22. The driving circuit for a piezoelectric transformer according to claim 21, wherein the load is a cold-cathode tube.

23. A driving circuit for a piezoelectric transformer, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load;

a detection section for detecting an output state to the load to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5, and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer.

24. The driving circuit for a piezoelectric transformer according to claim 23, wherein the load is a cold-cathode tube.

25. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

26. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a

predetermined time ratio, and

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current of a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

27. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.

28. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving

signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

29. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric

transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio,

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

30. A cold-cathode tube light-emitting apparatus, comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio,

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.

31. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

32. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving

signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current of a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

33. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric

transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.

34. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

35. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio,

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

36. A liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus

comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio,

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.

37. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

38. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current of a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

39. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a

frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.

40. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and

the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio.

41. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio,

the control section sets the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio.

42. A device with a built- in liquid crystal panel including a cold-cathode tube light-emitting apparatus and having a brightness controlled by the cold-cathode tube light-emitting apparatus, the cold-cathode tube light-emitting apparatus comprising:

a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode;

a cold-cathode tube connected to the secondary side electrode of the piezoelectric transformer;

a detection section for detecting an output state to the cold-cathode tube to generate a detection signal;

a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on

the detection signal output from the detection section; and

a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section,

wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio,

the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios.